Bird Track Springs Fish Habitat Enhancement Project

Soils and Erosion

Report

Prepared for:

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1 Introduction

The Bird Track Springs Fish Enhancement Project has two activity areas; an active project area where restoration activities would occur along the Upper Grande Ronde River (GRR) and a log source area on private property south of the main active project area (Figure 3). The active project area is located on the Upper Grande Ronde River (GRR) between river miles (RMs) 144.7 and 146.1 along Highway 244 near the Bird Track Springs Campground in the Wallowa-Whitman National Forest and on private land (Figure 1). The project reach ranges from 3,050 feet of elevation at the downstream end to 3,139 feet at the upstream end and drains an approximately 475-square-mile watershed that reaches a maximum elevation of 7,923 feet. The mean annual precipitation averages 26.2 inches, most of which falls as snow during winter months. Most of the basin is forested (over 73 percent) and has very little development (less than 0.1 percent estimated impervious area) (U.S. Geological Survey [USGS] 2014). The reach was identified in the Upper Grande Ronde River Tributary Assessment (U.S. Bureau of Reclamation [Reclamation] 2014) as an unconfined geomorphic reach with high potential to improve physical and ecological processes to support salmonid recovery.

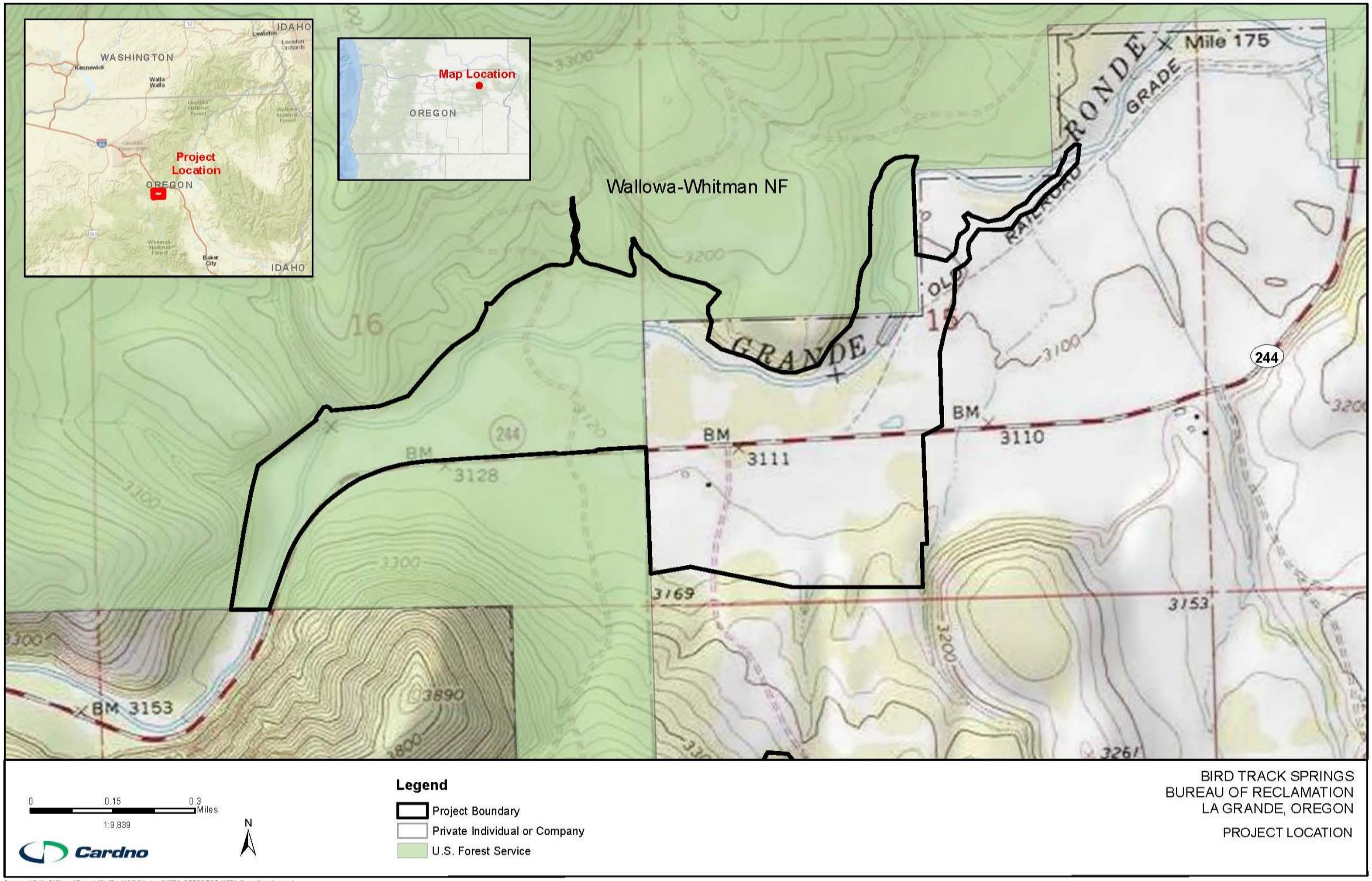

Figure 1. Active project area showing property ownership.

2 Affected Environment

2.1 Introduction

Soils are a complex mixture and their properties are based on source materials (geology), climate, vegetation, soil microbes, surficial processes, and time. The project area is located in the Blue Mountains physiographic province. The Blue Mountains originated in the Cenozoic era and feature extensive regional folding and faulting. The dominant geologic formation in the region is Grande Ronde Basalt, which is part of the Columbia River Basalt Group that covers large portions of the Pacific Northwest and originated in the Miocene. Locally, the Neogene sedimentary unit, which consists of tuffacious sedimentary rocks, originated in the Miocene/Pliocene era. The Powder River volcanic field has a small outcrop on the north side of the project area and also occurs to the south. It consists of Miocene-era andesite, dacite, and basalt that erupted from small volcanos located between La Grande and Baker City after the Columbia River Basalts were deposited. Most of the active project area is located in the GRR valley, which is covered with Quaternary surficial deposits consisting of alluvium (Oregon Department of Geology and Mineral Industries [DOGAMI] 2016). More detail on the regional geology, surficial geology, and geomorphic characteristics of the project area are presented in a Geomorphic Assessment appended to the Bird Track Springs Preliminary Basis of Design Report (Cardno 2016, Appendix B).

2.1.1 Soil Description

Soil descriptions and units described here are from the U.S. Department of Agriculture (USDA) *Soil Survey Report of Union County Area, Oregon* (1985). Additional soil data are available for the U.S. Forest Service (USFS) system lands portion of the project, but were not used since those data were not available for the private land portion of the project and the USDA soil survey covers the entire project area.

The upland soils are generally derived from the underlying basalt bedrock or tuff deposits and recent deposits of volcanic ash. They tend to have steeper slopes and be moderately deep, and moderately to well drained. They are used for wildlife habitat and timber production. The majority of the soils in the active project area in the GRR valley bottom are deep to moderately deep, well-drained soils that form in alluvial deposits. Their location in an active floodplain has subjected them to fluvial forces over time, which tend to disrupt the soil-forming processes that create deeper soil horizons that typically form through erosion, sorting, and deposition.

The soil unit that constitutes the majority of the active project area is Veazie-Voats complex (Unit 66, Figure 2). The complex is found on bottom lands and low stream terraces and has slopes of less than 3 percent. It consists of approximately 45 percent Veazie loam, 35 percent Voats fine sandy loam, and 20 percent other soils. Both Veazie loam and Voats fine sandy loam formed from basalt, andesite, or granite and are well drained. Permeability is moderate, runoff is slow, and the hazard of water erosion is slight. Both soil types are subject to flooding.

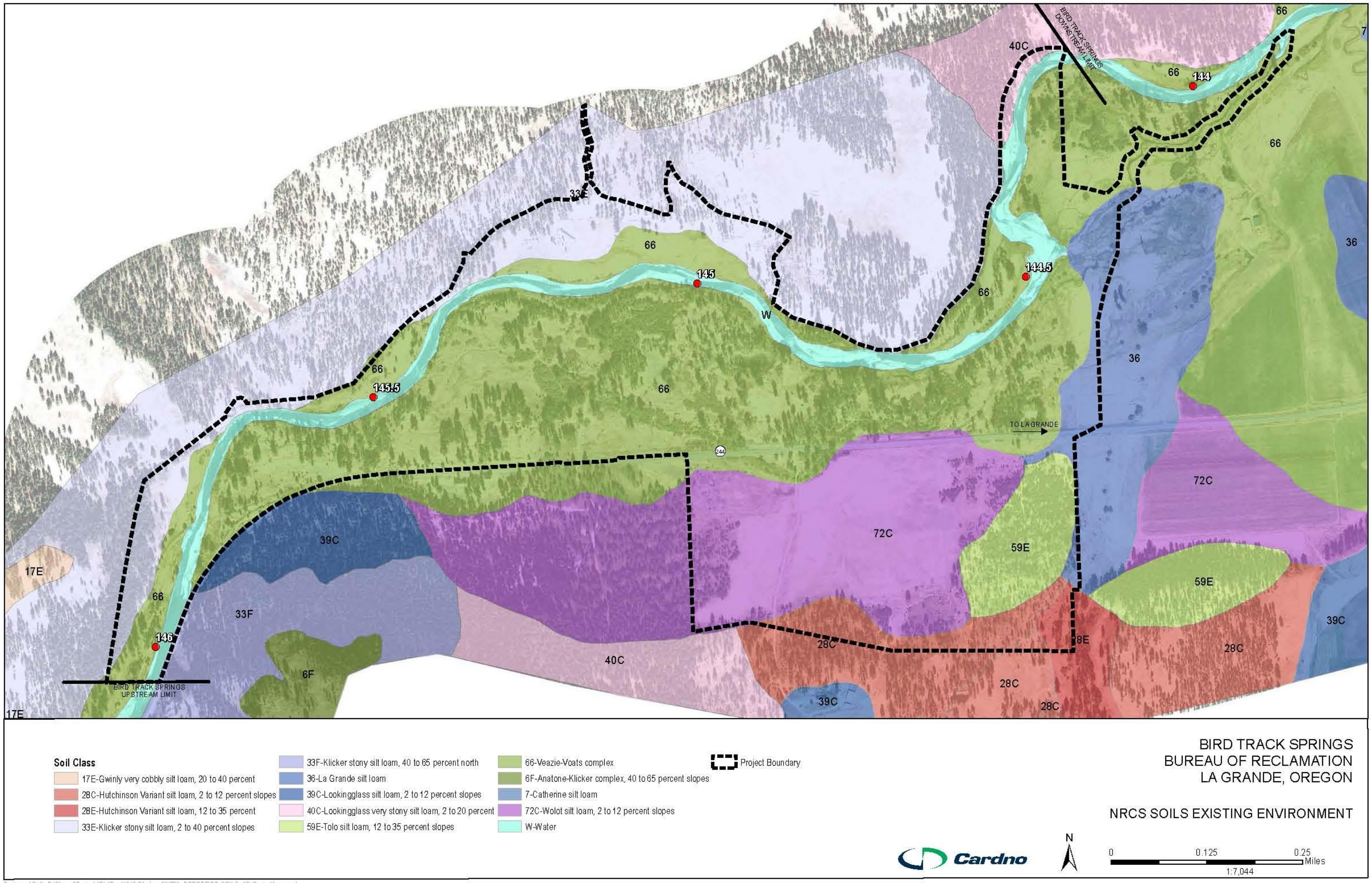

Figure 2. Active project area showing soil types.

Table 1 lists the soil types, acreages, and features of the soils within the active project area (soils covering less than 1 percent of the active project area were not included in the table). None of the soils are hydric. The hydrologic soil group rating is based on the soil's runoff potential. Group A generally has the smallest runoff potential, and Group D has the greatest.

Table 1: Soil Types and Characteristics of Soils within the Active Project Area

Code	Name / Surface Texture	Slope (percent)	Drainage Class	Hydro-logic Soil Group	Erosion Potential	Acres	Percent
28C	Hutchinson Variant silt loam	2–12	Well	D	Slight to moderate	9.1	3
33E	Klicker stoney silt loam	2–40	Well	C	Slight to high	25.9	9
36	La Grande silt loam	0–2	Moderately well	C	Slight	8.8	3
59E	Tolo silt loam	12–35	Well	C	Moderate to high	13	4
66	Veazie-Voats complex - loam	0–3	Well	B	Low	154	53
72C	Wolot silt loam	2–12	Well	C	Slight to moderate	53.6	18
W	Water					24.5	8

In addition to the general soil mapping units and descriptions from the soil survey described above, the active project area has additional features that were identified from field studies including wetlands (described in the Hydrology, Floodplains, and Wetlands Report), test pits dug for cultural resource investigations, and a geomorphic assessment that identified areas of soil disturbance. The geomorphic assessment identified elements that have impacted floodplain functions including abandoned railroad grades, road grades, and levees where soils have been disturbed by past activities. Recreational trails from the Bird Track Springs Campground also traverse the site. Trail use appears to be primarily by hikers, although occasional off-highway vehicle (OHV) use may occur on-site. Detrimental soil conditions on the USFS portion of the active project area were not determined quantitatively, but given the limited soil-impacting activities and minimal soil impacts observed on-site, detrimental soil conditions are estimated at well below 20 percent.

Test pits dug in the active project area for cultural resource investigations found that the typical near-surface alluvial stratigraphy includes a surface layer of fine sediment (<2 millimeters [mm] and smaller) interpreted as overbank flood deposits, underlain by a layer of river-lain sandy gravel. The thickness of overbank deposits varies from 0 to over 3 feet and averages 1.25 feet across the site, as documented by the cultural test pits. These overbank deposits are characterized texturally as silty sand to sandy silt. The underlying sandy gravel layer is projected to have grain sizes similar to those measured in eroding banks.

Soils types found in the log source area areas are listed in Table 2 and displayed in Figure 3. Most of the log source areas occur within the Klicker-Anatone complex (49 percent) and the Klicker stony silt loam (25 percent); both are well drained and have slight to high soil erosion potential, which is likely strongly influenced by the slope, with higher erosion potentials corresponding with higher slopes. The Klicker series is moderately deep and formed from basalt source rock with some loess and volcanic ash in the surface layer. The Anatone series is similar to the Klicker series in composition, but tends to be shallower. These soil types occur on uplands with timber cover.

Table 2: Soil Types and Characteristics of Soils within the log Source Areas

Code	Name / Surface Texture	Slope (percent)	Drainage Class	Hydro-logic Soil Group	Erosion Potential	Acres	Percent
5E	Anatone-Bocker Complex – extremely stony loam/very cobbly silt loam	2–35	Well	D	Slight to moderate	27.8	3
6F	Anatone-Klicker complex – extremely stony loam/stony silt loam	40–65	Well	D	High	6.5	1
19E	Hall Ranch stony loam	2–35	Well	C	Moderate	55.1	6
33E	Klicker stony silt loam	2–40	Well	C	Slight to high	243.5	25
33F	Klicker stony silt loam	40–65	Well	C	High	11.4	1
35E	Klicker-Anatone complex – stony silt loam/extremely stony loam	5–40	Well	C	Slight to high	485.9	49
38E	Loneridge stony silt loam	12–40	Well	C	Moderate to high	9.3	1
39C	Lookingglass silt loam	2–12	Moderately well	C	Slight to moderate	86.7	9
40C	Lookingglass very stony silt loam	2-20	Moderately well drained	C	Slight to moderate	34.8	4
59E	Tolo silt loam	12-35	Well	C	Moderate to high	16.5	2

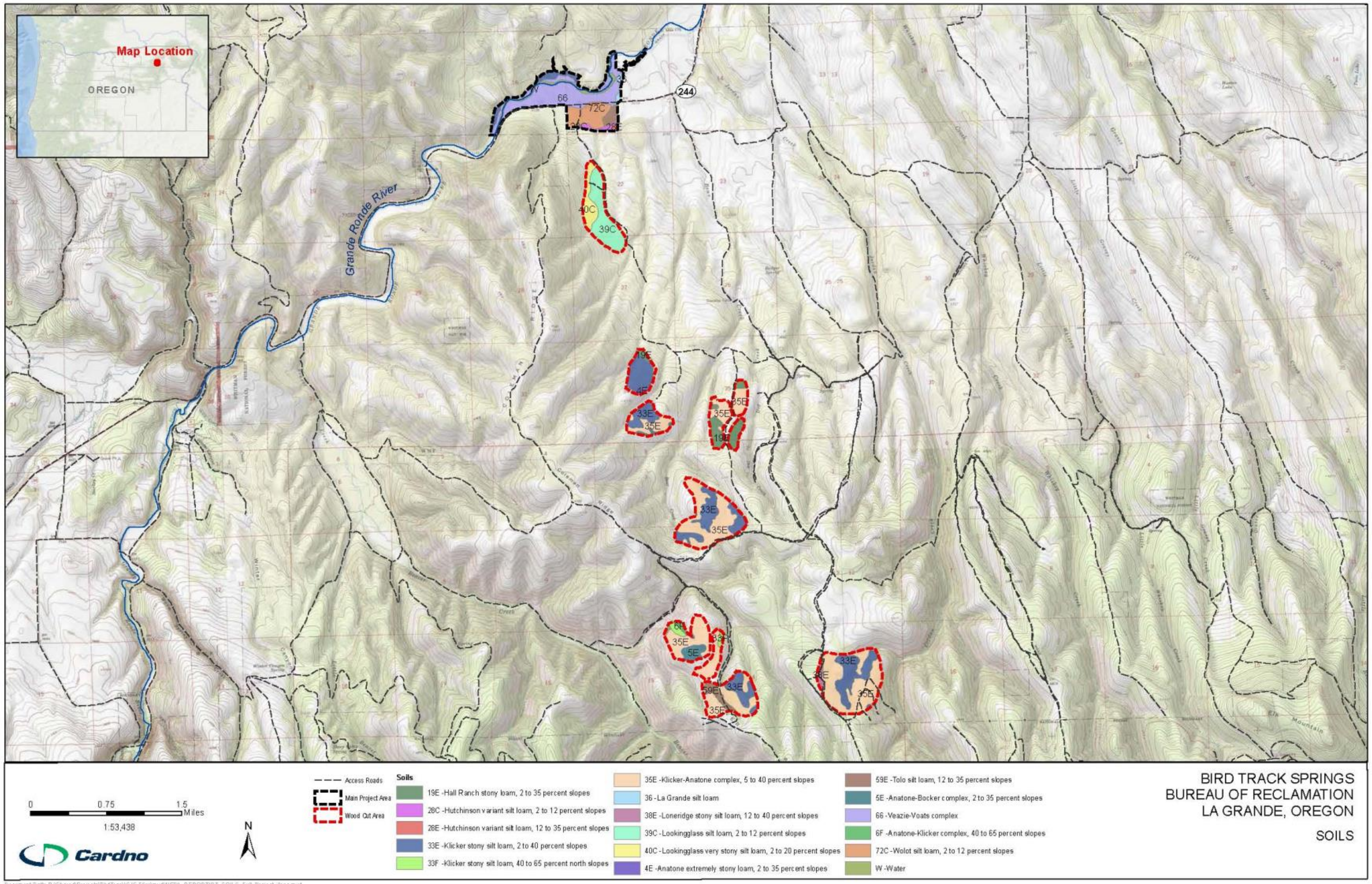

Figure 3. Active project area and log source areas with soil types.

3 Impacts Analysis

3.1 Introduction

The following describes the potential impacts of implementing the proposed action on soils in the active project area and the upland log source areas with a focus on impacts to soil including the potential for erosion and loss of soil productivity.

3.2 Methods and Assumptions

There are two areas of analysis for this project: the active project area (Figure 2) and the log source area, which includes areas where trees would be harvested on private land in the hills south of the project area (Figure 3). The active project area is approximately 293 acres and includes the channel modifications, storage and staging areas, temporary roads, and one area where trees would be harvested and staged on the south side of Highway 244. The log source area includes 982 acres of upland forests located a few miles south of the project area in the Bear, Dog, Jordan, and Beaver creek drainages (Figure 3).

Soil erosion is a natural process that can be accelerated by land management activities; the rate of erosion depends on soil texture, rock content, vegetative cover, and slope. For example, ash soils have higher erosion hazard ratings than other soils due to their low bulk density and high detachability. This hazard can be minimized by operating on slopes less than 30 percent with good vegetative cover. Vegetation binds soil particles together with roots, and vegetative cover—including biological crust and duff/surface material—protects the soil surface from raindrop impact and dissipates the energy of overland flow (USFS 2015).

Soil productivity of a site is defined as the ability of a geographic area to produce vegetative biomass, as determined by abiotic conditions (e.g., soil type and depth, rainfall, and temperature) in that area. Specifically, as related to soils in this analysis, productivity is related to the capacity or suitability of a soil for establishment and growth of appropriate plant species, primarily through physical impediment to root growth, water availability, and nutrient availability.

Productivity of forested and non-forested plant communities is closely related to ash and loess content in soils. Characteristics of ash soils include: 1) high water holding capacity, 2) high water infiltration rates, 3) low bulk density, 4) low strength, 5) high compactibility, 6) high detachability, and 7) disproportionately high amounts of nutrients in upper surface layers. Ash soils can contain volcanic glass fragments, and in general are susceptible to disturbance from forest management practices. Under undisturbed conditions, these soils support good vegetation cover, which protects the ash from erosion (USDA 2007).

Key indicators for the analysis include:

- Acres of soil disturbance
- Acres of potential soil compaction and displacement
- Acres of new and temporary roads

Project impacts and potential changes in key resource indicators have been estimated for two time frames: short and long term. Short-term impacts generally occur in the period during and immediately after construction, but could last up to 2 years from the start of the project. Long-term impacts occur in the period of time between the end of short-term impacts and approximately 5 to 25 years in the future. Conservation measures and best management practices (BMPs) that would be followed during design and construction of the project have been included in this analysis and are described in Description of Alternatives section of the EA.

Management activities can result in direct, indirect, and cumulative impacts to soil productivity and stability (USFS 1998). Impacts may be beneficial or adverse and could include alteration of physical, chemical, and/or biological characteristics or properties of soils.

Types of soil impacts expected to occur under implementation of the proposed action are summarized here and described in more detail in Section 3.3. Impacts to soils can be short term in the case of erosion potential; the length of time for which risk of soil erosion is a concern depends on soil type and vegetative cover. The most adverse impacts of management activities on soils are described as detrimental compaction, detrimental puddling, detrimental displacement, detrimental burning, detrimental erosion, and detrimental mass wasting; other concerns include adverse changes in vegetation and organic matter on the soil surface, and adverse changes in the water table (USFS 1998). Soil compaction, puddling, displacement, severe burning, and impacts to ground cover (vegetation and organic matter) are direct impacts; soil erosion, mass wasting, and changes in the water table are indirect effects. Erosion control measures normally occur immediately following treatments, and/or revegetation occurs in the first year or two. Other impacts to soils such as compaction, rutting, and displacement tend to be longer term and can be cumulative in nature if soils have not fully recovered prior to a new activity occurring in the same location. Cumulative effects are the sum of incremental changes in past, present, and reasonably foreseeable future direct/indirect impacts on the soil resource that overlap both in time and space.

3.3 Direct and Indirect Impacts to Soils

3.3.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, the restoration project would not occur in the floodplain and trees would not be harvested in the log source area. Activity on National Forest lands would continue to be governed by current land management and transportation plans and could include agency actions such as road maintenance, noxious weed treatments, and public activities such as fuel-wood removal, mining, and recreation. Activities on private lands would continue and could include actions such as grazing, timber removal, vegetation management, and recreation. Other Reclamation restoration projects would likely be constructed along the GRR.

All current detrimental soil conditions would continue to exist, with some conditions improving, others remaining static, and still others deteriorating over time. Some new detrimental soil conditions are likely to occur from the above-listed ongoing activities.

3.3.2 Alternative 2 – Proposed Action

A detailed description of the proposed action is provided in the Proposed Action and Alternatives section. Proposed activities in the active project area that could impact soils include:

- Temporary access road construction and use
- Staging area construction and use
- Grubbing, grading, cutting, and filling
- New channel construction and back-filling
- Placement of logs, boulders, rock, and fill
- Potential leaks and spills from construction equipment

With the exception of logs, some large boulders, additional rock, native seeds, and seedlings, all materials used for the project would be from within the project site and repurposed in construction of new channel features and floodplain elements. Existing boulder-rock weirs would be removed and boulders repurposed as habitat features or structural ballast. Abandoned reaches of the existing channel would be filled using excavated material from constructed channel segments. Figure 4 illustrates the proposed new channel configuration and the areas of the existing channel that would be filled. Existing riparian vegetation, topsoil, shrubs, and trees that require removal would be salvaged and reused in the floodplain. At this time, it is not expected that any native materials would be removed from the project site. Non-native materials (trash, noxious weeds, etc.) would be removed if found during construction.

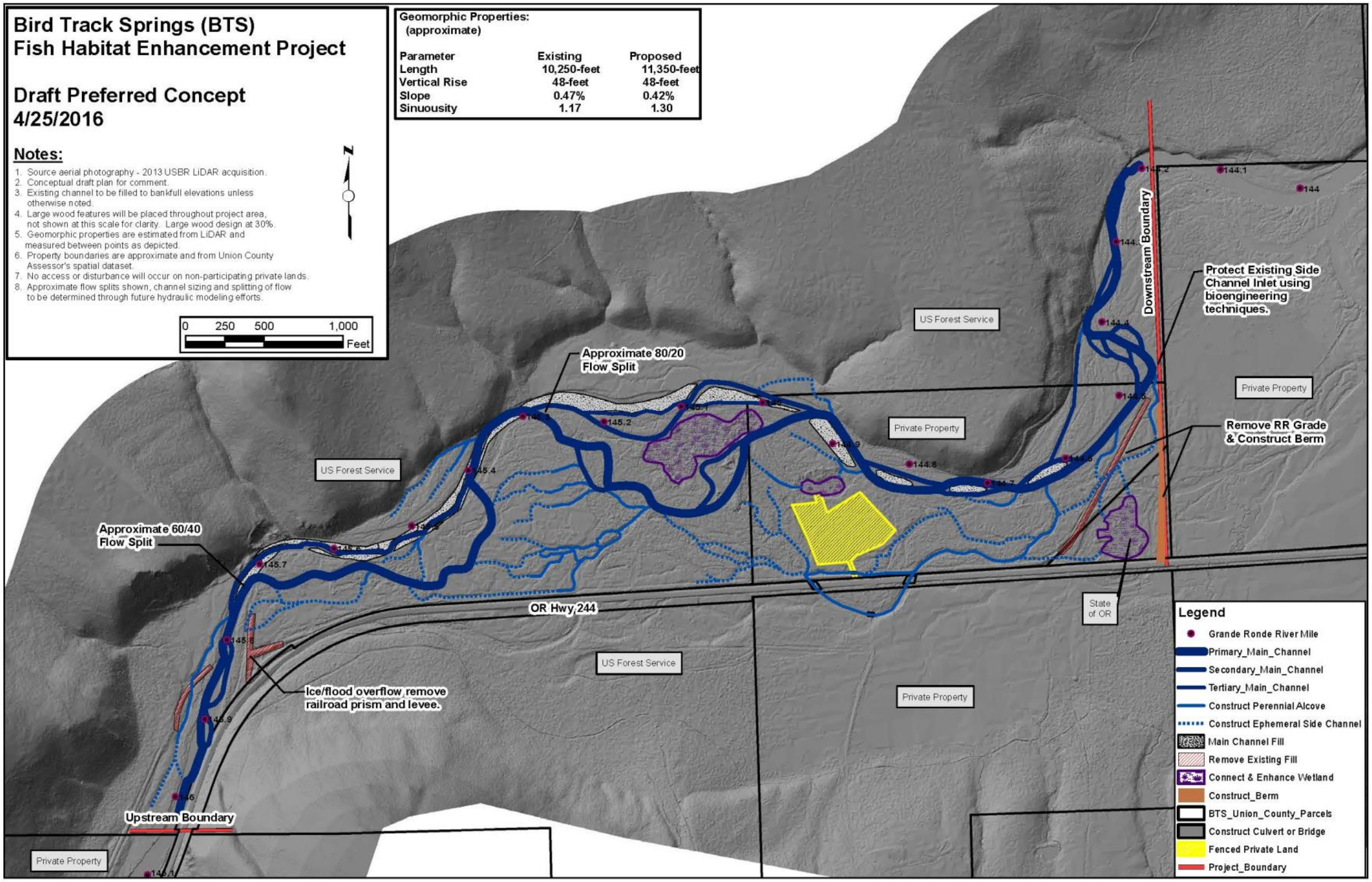

Figure 4. Draft concept showing areas of new channel and old channel fill.

Potential impacts to soils include removal of the organic layer and vegetation exposing mineral soils over approximately 35 acres to splash, sheet, rill, and gully erosion; compaction and displacement of surface and subsurface soil layers; mixing of soil layers during recontouring and restoration; and contamination with pollutants from leaks and spills. All of these potential impacts could reduce soil productivity and contribute to sedimentation in the river. Table 3 lists the proposed activities and the area of each soil type affected. Figure 5 shows mapped soil types with the proposed project elements.

Table 3: Acres of Soil Disturbance by Activity and Soil Type (acres)

Soil Code	Bar-Constructed	New Channel	Existing Access Road	Large Woody Material Staging	New Access Road	Staging and Storage Area	Total
28C				0.19			**0.19**
28E				0.09			**0.09**
33E		0.03			0.46	2.52	**3.01**
33F		0.04					**0.04**
36		0.00		1.16	0.35	0.75	**2.25**
39C		0.00			0.00		**0.01**
59E				10.55	0.00		**10.56**
66	2.52	8.12	0.16		11.16	24.72	**46.67**
72C			0.15	0.11	1.05		**1.31**
Water	2.58	13.39			0.55	0.57	**17.09**
Total	5.10	21.58	0.30	12.10	13.58	28.55	**81.21**

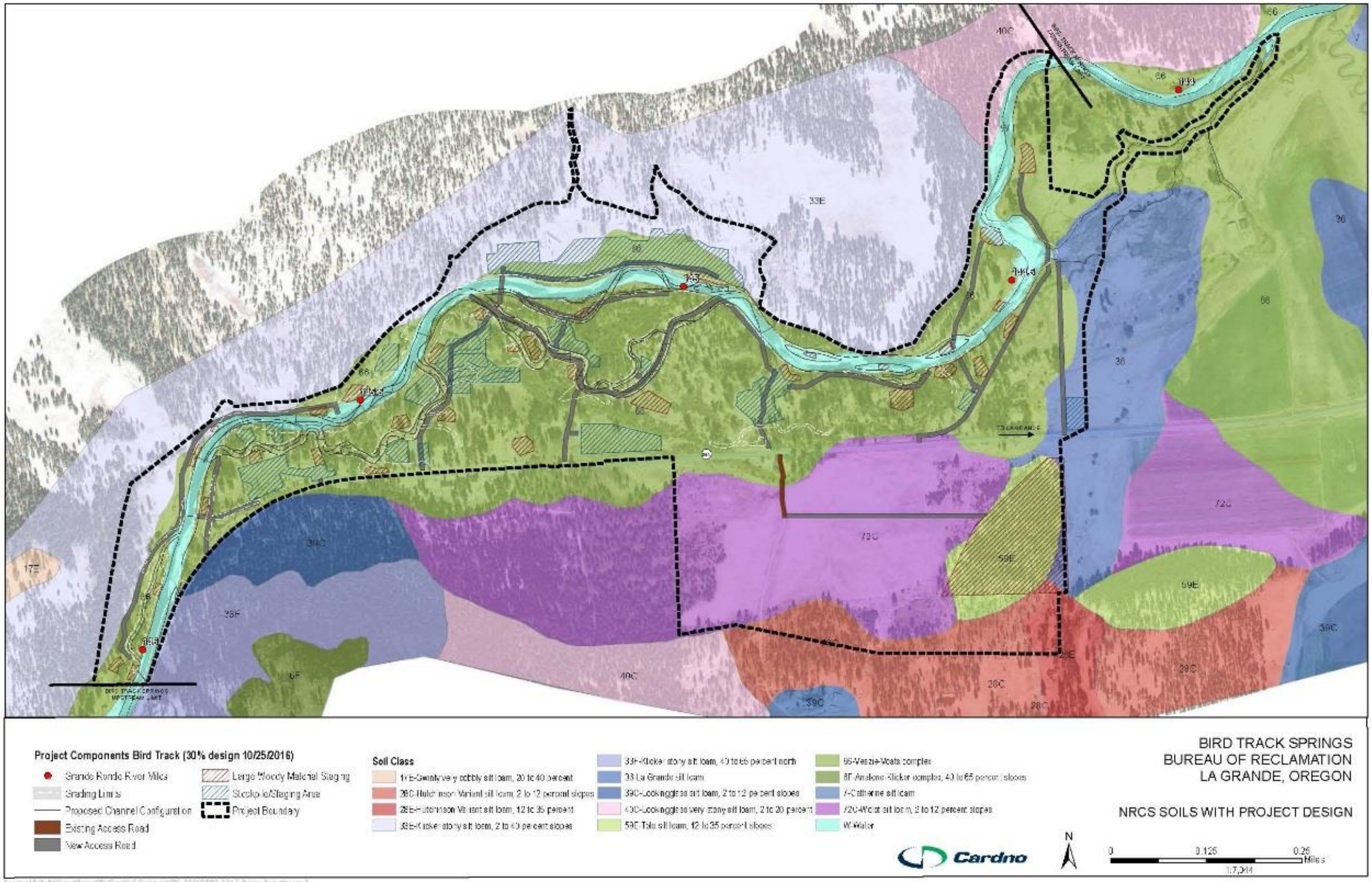

Figure 5. Active project area showing proposed project elements and mapped soil units based on the Soil Survey Report of Union County Area (1985).

Logs would be obtained from various sources as described in the Log Source Area section of the project description (Table 4). One source is a 12-acre plot in the active project area, where trees would be harvested and staged. Potential impacts from that area are included in the active project area analysis. Additional logs would be harvested from the log source areas south of the active project area on the Jordon Creek Ranch. Logs would be harvested using low-density selective harvest methods and hauled on existing roads to the active project site. Proposed activities in the log source areas that could impact soils include:

- Using ground-based logging equipment (tractors or forwarders) to harvest trees
- Soil disturbance from pushing trees over to include rootwads
- Creating temporary landings and slash piles
- Skidding logs
- Driving logging trucks on access roads and at loading sites

Table 4: Wood Quantity Summary

Size Class (Diameter)	Key Member (18"+)	Medium Log (12"–18")	Racking Logs (6"-12")	Pinning Logs (12")	Tree Tops & Branches (1"–6")	Large Boulders (>24")
Quantity	930	450	3,220	780	5,610	540

Potential impacts include soil compaction from equipment traffic; soil displacement from vehicle and equipment traffic and skidding; soil erosion from skid trails, landings, roads, and rootwad holes; and reduced nutrient availability due to removal of trees. Table 2 above indicates the acres of each soil type within the log source areas. It is assumed that tree removal would be dispersed throughout these areas.

Ground-based logging operations would result in direct and indirect effects on soil physical characteristics within the boundaries of proposed activity areas. Most detrimental effects would be concentrated on the proposed skid trails, temporary roads, landings, slash piles, and rootwad holes within or associated with timber harvest units. Minimizing the area occupied by landings and skid trails to reduce the detrimental effects on soil productivity from changes in physical soil properties is recommended in several papers (Garland 1983; Page-Dumroese 1993; Williamson et al. 2000).

System roads, skid trails and landings would be laid out to occupy less than 20 percent of the activity unit. Spacing skid trails to 75 and 100 feet apart limits detrimental disturbance to less than 20 percent of the activity area. Designated skid trails with 100-foot spacing impact 11 percent of a harvest area (Garland 1983). Literature indicates that Regional Soil Quality Standards can be met by using designated skid trails.

In addition to using designated skid trails and landings, there would be potential to reduce soil effects further by limiting equipment operation, to the extent possible, on skid trails when soils are drier than field capacity (McNabb et al. 2001; Startsev et al. 2001). Rutting and puddling are most often associated with logging on wet soils (Williamson et al. 2000). Most summer logging would occur when soils are drier than field capacity. By operating on low soil moisture conditions we have the potential to reduce the amount of detrimental disturbance from skidding operations.

All temporary road construction, landings, and log skidding corridors constructed for this project would be reclaimed to less than 20 percent detrimental soil disturbance (per unit) by any site-appropriate combination of the following:

- Removing any installed culverts or temporary bridges,
- Recontouring the entire template to nature ground contour,
- Where recontouring is unnecessary, subsoiling will be used to ameliorate the presence of detrimental soil compaction,
- Seeding with the native plant mix as specified by the Forest Botanist,
- Placing woody material, and
- Planting native shrubs/trees to augment natural vegetation

Re-contouring activities would not ameliorate the long-term impacts to soil productivity immediately, but would improve soil conditions compared to those on an existing or abandoned road. The establishment of vegetation and associated additions of organic matter would encourage recovery over time. Re-contouring and subsoiling would provide a suitable seed bed for native forest vegetation while increasing soil hydraulic conductivity, organic matter, total carbon, and total nitrogen (Lloyd et al. 2013). These conditions would likely accelerate the recovery of the soil productivity. Additional protection of the soil resource would be afforded by only allowing ground-based logging operations to occur when soils are dry, snow covered, or frozen.

Erosion is expected from temporary roads and extended log skidding corridor construction where native surfaces are exposed to rainfall impact and overland flow. Some areas would likely have short-term increases of soil erosion above 2 tons per acre per year. Erosion rates would decrease as roads are obliterated immediately following use. Where there is a risk of soil erosion, it would be minimized by implementing the following management practices:

- Reducing the area where equipment operates,
- Locating landings on relatively flat ground that can be properly drained, locating skid trails on slopes less than 35 percent that have soils with a low or moderate erosion hazard,
- Using erosion control features, such as water bars, replanting, and placing slash on disturbed soils.

Sediment from the permanent transportation system has direct effects on water quality, but is not a component of the soil quality assessment process. These effects are evaluated in the Aquatics Section.

4 Cumulative Effects on Soils

Potential cumulative effects are analyzed by considering the proposed activities in the context of past, present and reasonably foreseeable actions. Reasonably foreseeable future actions are defined as activities that will occur within the next 5 years. These are the areas where cumulative effects have occurred or may occur. In addition, some activities have an influence that may extend downstream in the subwatershed within the project area boundary. This broad area is referred to as the “cumulative effects analysis area,” and in general all alternatives are considered in the context of relevant past, present, and reasonably foreseeable activities in this area. Activities that occurred in the past have been incorporated into the existing condition assessment of the project area.

4.1 Alternative 1 – No Action Alternative

The only reasonably foreseeable future actions that would overlap in time and space within this project area that have the potential to result in short-term increase in soil impacts would be OHV use, livestock grazing, and continued timber management on private lands.

However, the Longley Meadows Restoration Project is located immediately downstream of the Bird Track Springs Fish Enhancement Project and is proposed to have similar restoration elements.

Erosion is expected to be localized to areas with OHV use, livestock grazing, and continued timber management on private lands. Soils in areas within the project boundary that are at wildfire risk could be influenced by a combination of wildfire and the erosion processes accompanied with high winds. Winds can transport soil aloft and to a new location. This would prove to be a loss to soil productivity within a proposed unit, if this occurs it is unknown if some portion of this material would end up as sediment. The potential duration of expected erosion risk would be for at least 3 years immediately following wildfire (Elliott et al. 2001; Robichaud 2000). The volumes of erosion under this risk are also influence by the intensity and duration of precipitation events that occur during elevated erosion risk. Detrimental soil conditions that are assumed to be created by equipment traffic may be long-lived (>40 years).

4.2 Alternative 2 – Proposed Action

A summary of the present and reasonably foreseeable future management activities in the cumulative impacts analysis area is presented in Table 5 and has been used to assess the cumulative impacts of implementing this project on soil resources.

Table 5: Cumulative Effects Determination Table.

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Effects
		Time	Space		
Noxious Weed Management: Wallowa-Whitman Invasive Species Treatment Record of Decision	Reduction of invasive species competition	Yes	Yes	No	No impacts to soil resources expected.
Vegetation Management: Bird Track Springs precommercial thinning and prescribed burning		No	No	No	
Special Uses: OTEC Powerline Fly Fishing O/G Permit		Yes	Yes	No	Powerline is suspended over the river; no impacts expected from this powerline or fly fishing to soils.
Recreation: Bird Track Springs Interpretive Trail		Yes	Yes	No	This trail would be moved as part of this project; therefore, this would be a direct/indirect effect, not cumulative.
Recreation: Dispersed camping		Yes	Yes	No	No impacts to soil resources expected.
Recreation: Snowmobile trails		No	No	No	
Recreation: Firewood cutting		Yes	Yes	No	No impacts to soil resources expected within the cumulative effects analysis area.

Table 5: Cumulative Effects Determination Table.

Project	Potential Effects	Overlap in: Time	Overlap in: Space	Measurable Cumulative Effect?	Effects
Recreation: OHV use		Yes	Yes	No	Unauthorized user-built OHV trails and OHV use is spread across most of the landscape within the Spring Creek area, contributing to sediment production and soil compaction. Soils could be impacted in the short term, but the long-term benefits of the project and implementation of travel management within the project area would yield a net improvement in soil conditions.
Recreation: Bird Track Springs Campground		Yes	Yes	No	The campground is separated from the GRR by Highway 244. Recreation activities within the campground have no effect on the active project area.
Roads & Trails: Travel Management Plan		Yes	Yes	No	See OHV use above.
Road maintenance on Highway 244		Yes	Yes	No	No impacts to soil resources expected within the cumulative effects analysis area.
Roads: Danger Tree Removal		Yes	Yes	No	No impacts to soil resources expected within the cumulative effects analysis area.
Grazing Allotment: Spring Creek sheep allotment		No	No	No	
Fisheries Enhancement: Fish logs from Bird Track Springs Campground Longley Meadows	Short-term soils impacts from restoration activities	Yes	Yes	Bird Track Springs Campground – No Longley Meadows – Yes	Some large tree removal is planned within the campground area for another fish enhancement project. Trees would be cut down, loaded with a log forwarder, and hauled off-site. Most of the removal is expected to occur from existing roads and no additional detrimental soil impacts are anticipated. The Longley Meadows project would have similar short-term impacts to those described above for this project. Long-term impacts are expected to be minimal.
Wildlife Enhancement:		No	No	No	

Table 5: Cumulative Effects Determination Table.

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Effects
		Time	Space		
GG Owl Platforms Aspen Enhancement					
Mining		No	No	No	
Private Land Activities: • Private Structures • Roads • Grazing		Yes	Yes	Structures – No Roads – No Grazing – Yes	Grazing – An existing corral on the private property portion of the active project area would be moved out of the project area, reducing livestock impacts to the soil.

As with the No Action Alternative, reasonably foreseeable actions include OHV use and livestock grazing. The Longley Meadows project, while different in its specifics, would also involve an intensive construction footprint on floodplain soils.

The Longley Meadows project, while different in its specifics, would also involve an intensive construction footprint on floodplain soils. The Longley Meadows project would have similar short-term direct and indirect impacts to those described above for the Bird Track project. Because the timing for initiating implementation of the Longley Meadows project would most likely be within 2-3 years following completion of the Bird Track project, the short term impacts to soils resources from this Bird Track project would most likely have been remediated and well into recovery with streambanks stabilized, vegetation establishing, and compacted soils rehabilitated and planted to native species. The changes in channel morphology and increased large wood within the Bird Track Springs reach would capture most of the residual sediment which may occur; therefore, due to rehabilitation and project design, negative cumulative impacts to soils resources are expected to be immeasurable when combined with the Longley Meadows project. Beneficial impacts to soils resources (such as rehabilitation of streambank erosion areas, decompaction, increased stabilization from vegetation and streambank structures, etc.) within these stretches however; are anticipated to be significantly improved across all ownerships.

Long-term impacts are expected to be minimal.

Displacement and erosion, the loss of topsoil, is a long-term and perhaps a permanent loss of soil productivity. However, best management practices and soil mitigation strategies outlined above would reduce the occurrence of displacement and erosion to be within the Region 6 standards. Compaction may last from 10 to 70 years (Gonsior 1983). Compaction can be adequately mitigated through subsoiling and decompacting skid trails and recontouring temporary roads to be within the Region 6 standards.

Subsoiling restores biological processes that are reduced by soil compaction (Dick et al. 1988). In general, tilling or scarifying a compacted soil improves productivity by reducing the resistance of soil to root penetration and providing improved soil drainage and aeration to enhance seedling establishment and tree growth (Bulmer 1998). Soil restoration is not the immediate result of ripping, planting, or any other activity. The goal of soil restoration is to create favorable conditions for impaired soils to begin the recovery process. Reductions in organic matter content reverse quickly as vegetation is established. Organic debris accumulates on the surface and roots grow and are decomposed in the soil. These organic materials break down and release nutrients and improve the quality of the soil by improving its structure and reducing compaction and other detrimental soil disturbances. Loss of organic-matter is a short-term change lasting about 10 years once vegetation returns to the soil.

Soil erosion would be controlled through the use of erosion control measures. In addition, bare soils would naturally recover to be re-vegetated with native seed. Any erosion that occurs would be short-lived, most likely occurring during the time between the soil disturbance and the implementation of erosion control measures.

Because this project would move an existing corral located on the private property portion within the active project area to outside of that area and outside of the riparian habitat, soils impacts from livestock management within the project area would be reduced. Livestock impacts to the soils within the area selected for the new corral location would be similar to those being experienced within the current location (compaction, disturbance, removal of vegetation). The corral would move from within Veazie-Voats complex (Unit 66; Figure 2) to within Wolot silt loam (Unit 72C, Figure 2). Wolot silt loam soils are deep, well drained upland soils, on 2 to 12 percent slope. They formed in volcanic ash deposited over a soil that formed in residuum and colluvium derived dominantly from basalt and loess. Permeability of Wolot soil is moderate to a depth of 20 inches and moderately slow below this depth. Wolot soils are in the Hydrologic Soil Group B. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. This soil type is mainly used for timber production, but also used for some cultivated crops and for wildlife habitat. These soils have moderately slow permeability, shrinking and swelling of the soil, and dustiness during dry periods. Wolot silt loam is in capability subclass IIe, nonirrigated. Soils in this class have moderate limitations that reduce the choice of plants or require moderate conservation practices. Subclass e are soils for which the susceptibility to erosion is the dominant hazard affecting their use. Soil erosion rates are poor indicators of loss in productivity because most soil is redistributed within a watershed and not necessarily lost to production (Elliot et al 1999). Wolot is of the Andisol soil order, which have relatively high water-holding capacity and natural fertility. Erosion may be severe on these sites, but productivity may decline little.

Unauthorized user-built OHV trails and OHV use is spread across most of the landscape within the Spring Creek area, contributing to sediment production, soil disturbance, and soil compaction. Soils could be impacted in the short term, but the long-term benefits of the project in combination with the implementation of travel management (which would manage cross-country motor vehicle use) within the project area is expected to yield a net improvement in soil conditions.

With restoration of soils in the project area and the resulting enhancement of floodplain function, detrimental soil conditions are expected to improve over the long term as overbank flows deposit sediment in the floodplain and riparian vegetation and trees become established (Graham 1994; Harvey et al. 1987, 1994). A similar outcome is expected for the Longley Meadows project. There could, however, be a temporary cumulative increase in erosion and sedimentation rates from the sites if a storm event of sufficient magnitude were to occur during construction.

4.3 Irreversible and Irretrievable Commitments for Soil Resources

The proposed action is not expected to create any impacts that would cause irreversible damage to soil productivity. Tree removal and floodplain construction would avoid landslide-prone areas, existing debris slides/debris torrents, and other potentially unstable lands on steep slopes. Careful planning, project design requirements, mitigation measures, and BMPs would be used to prevent irreversible losses of soil resources.

5 Additional Disclosures for Soil

5.1 Prime Farmlands, Rangeland, Forest Land

Actions taken under either alternative would have no impacts to farmland, rangeland, or forest land inside or outside the National Forest. There are no prime farmlands affected by the proposal.

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